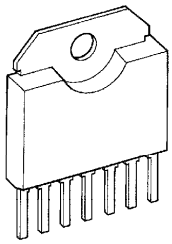
TOSHIBA BIPOLAR LINEAR INTEGRATED CIRCUIT SILICON MONOLITHIC

TA8050P

1.5A MOTOR DRIVER WITH BRAKE FUNCTION

The TA8050P is a 1.5A motor driver which directly drives a bidirectional DC motor. Inputs DI1 and DI2 are combined to select one of forward, reverse, stop, and brake modes. Since the inputs are TTL-compatible, this IC can be controlled directly from a CPU or other control system. The IC also has various protective functions.



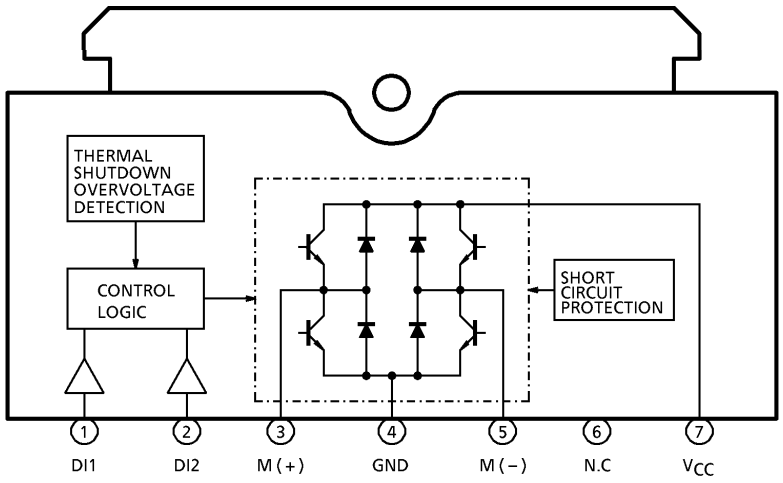
HSIP7-P-2.54

Weight : 1.9g (Typ.)

FEATURES

- Bidirectional DC motor driver
- Current capacity : 1.5A
- Four modes : Forward, Reverse, Stop, and Brake
- Protective functions : Thermal Shutdown, Short Circuit Protection, and Overvoltage Shutdown
- Built-in diode for counteracting counter electromotive force
- Plastic HSIP-7 pin

BLOCK DIAGRAM AND PIN LAYOUT



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PIN DESCRIPTION

PIN No.	SYMBOL	DESCRIPTION
1 2	DI1 DI2	Output status control pin. Connects to a PNP-type voltage comparator.
3	M (+)	Connects to the DC motor. Both the sink and the source have a current capacity of 1.5A. Diodes for absorbing counter electromotive force are contained on the V_{CC} and GND sides.
4	GND	Grounded
5	M (−)	Connects to the DC motor together with pin 3 and has the same function as pin 3. This pin is controlled by the inputs from pins 1 and 2.
6	(N.C)	Not connected
7	V_{CC}	Power supply pin. This pin has a function to turn off the output when the applied voltage exceeds 27.5V, thus protecting the IC and the load.

TRUTH TABLE

Input		Output		
DI1	DI2	M (+)	M (−)	
H	H	L	L	(Note)
L	H	L	H	
H	L	H	L	
L	L	OFF (high impedance)		(Note)

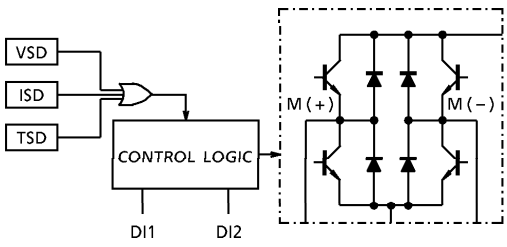
Note : Brake mode comes into effect when both M (+) and M (−) go low ; stop mode comes into effect when both M (+) and M (−) turn OFF.

DESCRIPTION OF MULTI-PROTECTIVE OPERATION

The TA8050P has functions for protection from overvoltage (V_{SD}), overcurent (I_{SD}), and overheat (T_{SD}). These functions protect the IC (and the motor load in some cases) from deterioration or destruction due to power-related overstress.

The three functions work independently.

Each function is explained below.



1. Overvoltage protection (V_{SD})
   - Basic operation

     When the voltage supplied to the V_{CC} pin is up to the V_{SD} detection voltage, the output is controlled by the input signals. However, when the V_{CC} voltage exceeds the detection voltage, the output enters high-impedance state regardless of the input signals.
   - Detailed explanation

     The V_{SD} voltage is detected by comparing the Zener voltage with the voltage obtained by dividing V_{CC} with a resistor. When the center voltage of the resistor is higher than the Zener voltage, a transistor-off instruction is issued to the control logic. When it is lower than the Zener voltage, the logic is controlled by the input signals from pins 1 and 2.
2. Overheat protection (T_{SD})
   - Basic operation

     When the junction (chip) temperature is up to the T_{SD} detection temperature, the output is controlled by the input signals. When it exceeds the T_{SD} detection temperature, the output enters high-impedance state regardless of the input signals.
   - Detailed explanation

     The temperature is detected by monitoring V_F of a diode on the chip. When the diode V_F is lower than the internal reference voltage, an output transistor-off instruction is issued to the control logic. When it is higher than the internal reference voltage, the logic is controlled by the input signals from pins 1 and 2.
3. Overcurrent protections (I_{SD})
   - Basic operation

     When the output current (pin 3 or 5, I sink or I source) is up to the I_{SD} detection current, the output is controlled by the input signals. When it exceeds the detection current, the output assumes a switching waveform as shown in Fig.1.

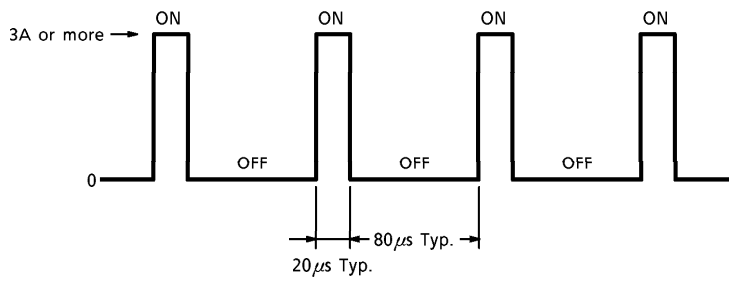


Fig.1 Basic Operation

   - Detailed explanation

     The output current is detected by monitoring the V_{BE} from each output transistor. One detection circuit connects to one of the output transistors and leads to the short-circuit protection circuit. When a current exceeding the I_{SD} detection current flows through one of the four output transistors, the short-circuit protection circuit is activated. This circuit contains a timer. When overcurrent condition continues for 20μs (typically), the protection circuit places the output in high-impedance mode and, 80μs (typically) later, returns the IC to ON mode. The switching-waveform output is repeated until overcurrent condition is no longer present.

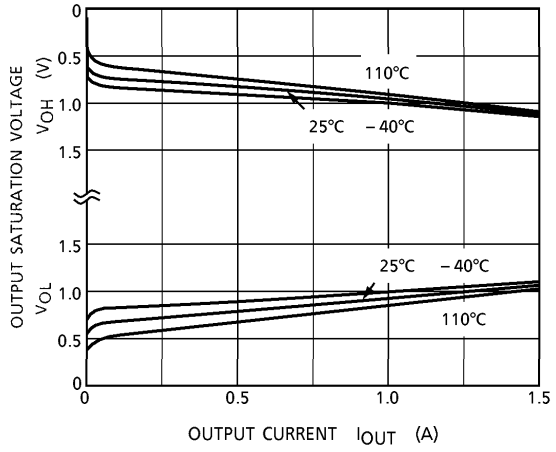
MAXIMUM RATINGS (Ta = 25°C)

CHARACTERISTIC	SYMBOL	RATING	UNIT
Supply Voltage	V_{CC}	30	V
	V_{CC}	60 (1s)	
Input Voltage	V_{IN}	− 0.3 to V_{CC}	V
Output Current	$I_{O\cdot AVE}$	1.5	A
Operation Temperature	T_{opr}	− 40 to 110	°C
Storage Temperature	T_{stg}	− 55 to 150	°C
Power Dissipation	P_D	12.5	W
Lead Temperature-time	T_{sol}	260 (10s)	°C

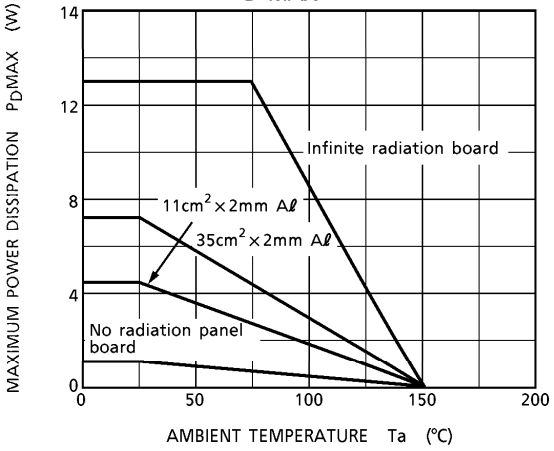
ELECTRICAL CHARACTERISTICS (V_{CC} = 6 to 16V, Tc = − 40 to 110°C)

CHARACTERISTIC	SYMBOL	PIN	TEST CIR-CUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Current Consumption	I_{CC1}	V_{CC}	—	Stop	—	8	15	mA
	I_{CC2}		—	Forward / Reverse	—	27	50	
	I_{CC3}		—	Brake	—	16	30	
Input Voltage	V_{IL}	DI1 / DI2	—	—	—	—	0.8	V
	V_{IH}		—	—	2.0	—	—	
Input Current	I_{IL}	DI1 / DI2	—	V_{IN} = 0.4V	—	—	− 100	μA
	I_{IH}		—	V_{IN} = V_{CC}	—	—	100	
Output Saturation Voltage	V_{sat} (total)	M (+) / M (−)	—	I_O = 1.5A, Tc = 25°C	—	2.2	2.9	V
			—	I_O = 1.5A, Tc = 110°C	—	2.2	2.8	
Output Leakage Current	$I_{LEAK\cdot U}$	M (+) / M (−)	—	V_O = 0V	—	—	− 100	μA
	$I_{LEAK\cdot L}$		—	V_O = V_{CC}	—	—	100	
Diode Forward Voltage	$V_{F\cdot U}$	M (+) / M (−)	—	I_F = 1.5A	—	2.6	—	V
	$V_{F\cdot L}$		—		—	1.5	—	
Overcurrent Detection	I_{SD}	—	—	—	1.8	3	4	A
Shutdown Temperature	T_{SD}	—	—	—	—	150	—	°C
Overvoltage Detection	V_{SD}	—	—	—	25	27.5	30	V
Thermal Resistance	$R_{\theta j\text{-}c}$	—	—	—	—	4	—	°C / W
Transfer Delay Time	t_{pLH}	—	—	—	—	1	10	μs
	t_{pHL}	—	—	—	—	1	10	

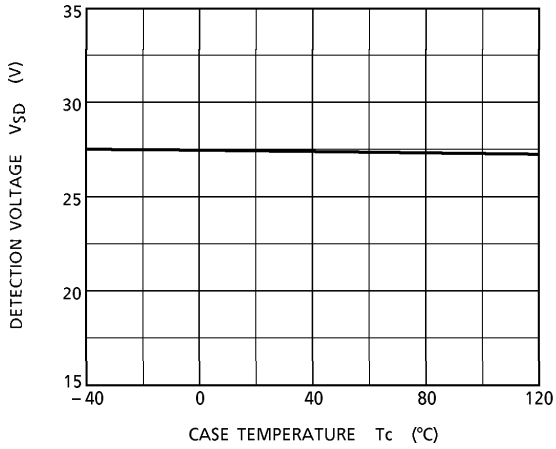
I_{OUT} – V_{OL}, V_{OH}



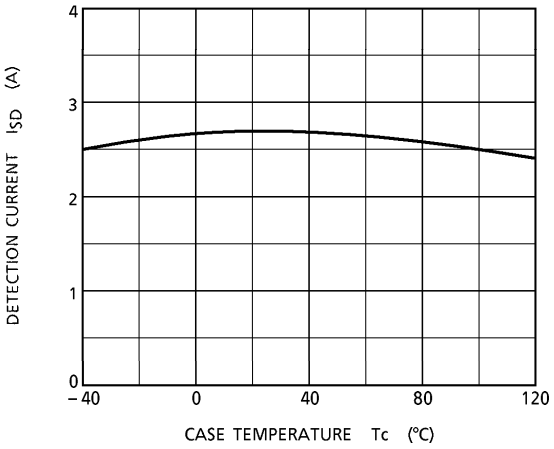
$P_{D\ MAX}$ – Ta



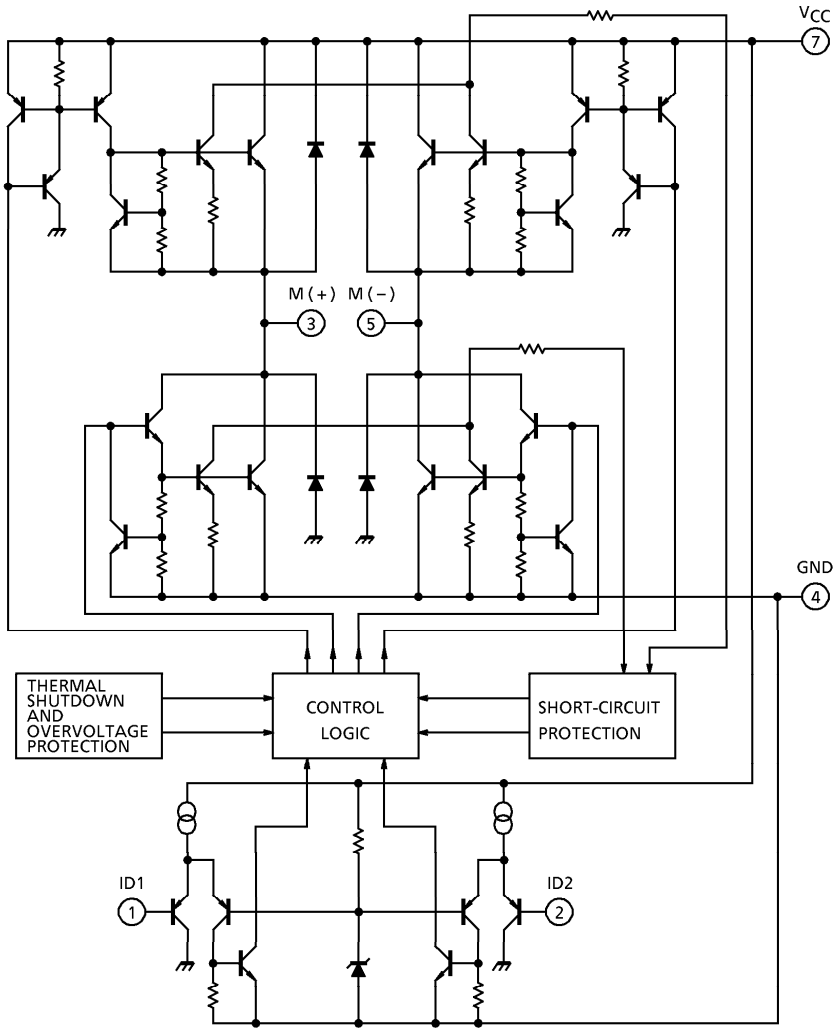
V_{SD} – Tc



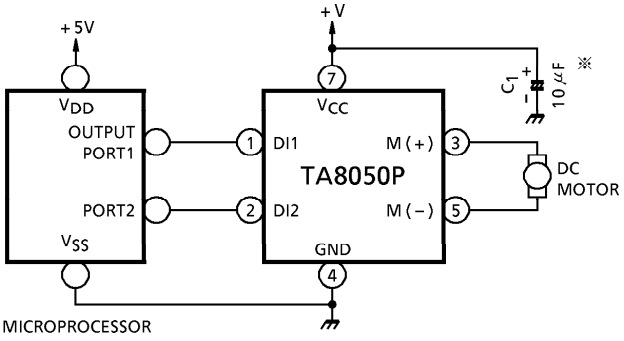
I_{SD} – Tc



I/O EQUIVALENT CIRCUIT



EXAMPLE OF APPLICATION CIRCUIT

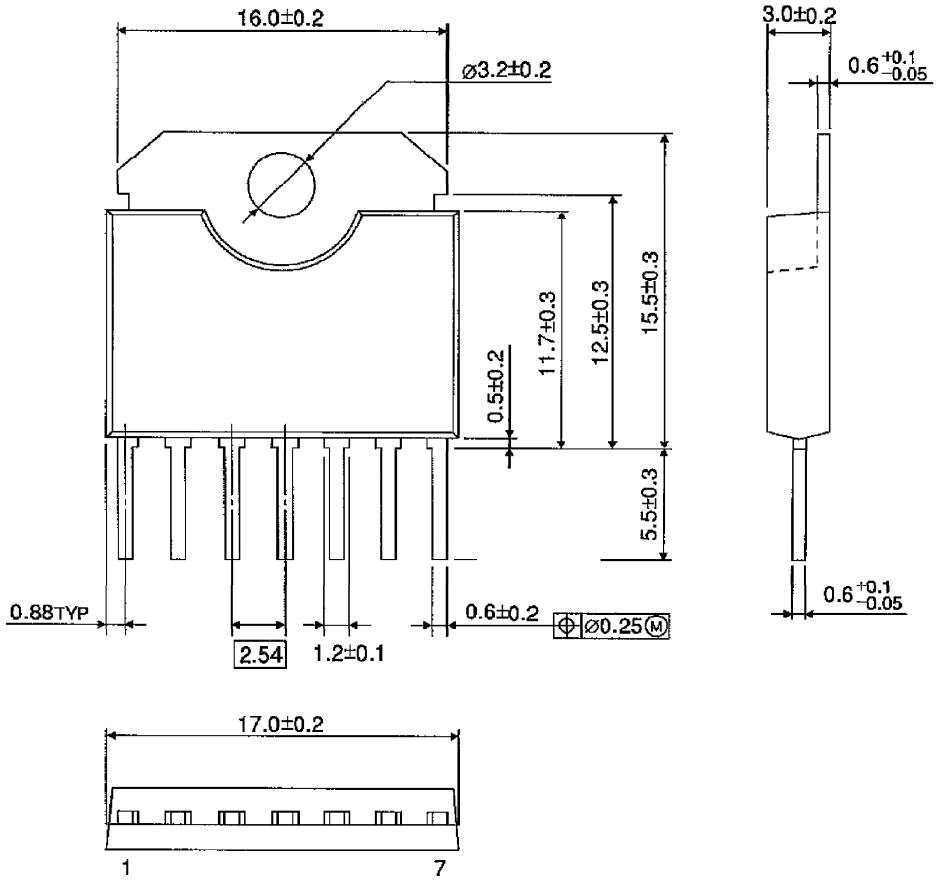


※ Connect this capacitor as close to the IC as possible.

OUTLINE DRAWING

HSIP7-P-2.54

Unit : mm



Weight : 1.9g (Typ.)